REMARKS

As suggested by the Examiner, Claim 32 has been canceled as being redundat over the prior amendment to Claim 26.

Before addressing the particular issues raised by the Examiner, it may be worthwhile recapitulating the nature and purpose of the present invention. The invention deals with the problems that arise when one seeks to bond together reinforced composite material having different coefficients of thermal expansion so that on heating to and cooling from a temperature at which bonding occurs shape distortions may occur. By use of the expansion compensating tooling specified in Claim 26, effective control of the differential expansion of subcomponents of the structure and induced stresses and distortion may be controlled. The tool used in the invention does not have a similar thermal expansion as the second component, but is a tool having a very different thermal expansion than the component This is explicitly set out by the requirement set out in feature (a)(1) of Claim 26 that " said tooling having a coefficient of thermal expansion that differs from said second component". Then, by means of the roughness of the tool, and with the help of the pressure of the vacuum bag, the tool and the component become a unique and becoming in a solidarity body having a common thermal expansion coefficient, similar to the thermal expansion coefficient of the first component. This "tailoring" of the tool is nowhere disclosed in any of the cited art.

Dealing first with the obviousness-type double patenting rejection, the key issue seems to be what exactly is taught by Claim 1 of US 6,508,909. The examiner equates its angle pieces with the expansion compensating tooling required by the present claims.

This is not the case. Nothing in Claim 1 of US 6508909, or indeed in the specification thereof,

suggests that the angle pieces have a different coefficient of thermal expansion from either of the pieces which they contact. Nor is there any suggestion that they should have rough surfaces to maintain that contact along the surface they contact throughout the heating and cooling cycle. Claim 1 of US 6508909 gives no details of the nature of the angle pieces in question. They are, however, described at column 3 lines 10 - 15 and the claim should be construed in a manner consistent with this description, which reads as follows:

> The stringer 2 is confined between two angle pieces 4, 4' of steel, aluminum, pneumatic cushion, etc., preferably Invar, like those shown in FIG. 2 which are adapted to the shape of the stringer 2. These angle pieces have a series of channels where elastomeric pipes tubes or pipes 5, 5' are housed, retaining the resin flow of the composite material of the stringer 2. The location, shape and exact sizing of such pipes is carried out according to the aforementioned resin flow optimisation and that of the grip-torque over the stringer 2 during the curing process.

Nothing in this suggests the need for a different coefficient of thermal expansion from the parts being contacted. Nothing suggests the need for either a machined rough surface or a friction enhancer. Such tailoring of the tool as is required of the present invention is not obvious in view of Younie and Artz either, because like US 6,508, 909 in all of these documents, the tool used has a similar expansion coefficient than that of the part to be manufactured. Younnie teaches that one should adjust the thermal coefficient of expansion of the tooling concepts by using tools compose of rigid and compliant parts. It is stated at column 3 lines 51 -59

> Using multiple materials having differing thermal expansion coefficients allows tools, according to the present invention, to be carefully tailored to overcome problems presented by complex composite parts. Thus, through the use of the present invention, the tooling can be designed to provide increased thermal expansion in areas of the composite part that require it and lower magnitudes of thermal expansion in areas that do not require as much tool expansion to produce good part consolidation.

This is not a teaching to use tools with coefficients of expansion different from the pieces being consolidated, nor is it a teaching for rough surfaces or friction enhancement.

Artz specifically teaches that the tooling material should be matched to the composite structure being fabricated (see abstract) and so points directly away from the present invention.

Thus, the assumption made by the Examiner with regard to "*Art and Younie disclose a method of forming composite articles wherein the tooling is chosen such that it achieves a common thermal expansion with the component without requiring the tooling to have the same coefficient of thermal expansion*" is not correct.

We now turn to the rejection of Claims 26, 28, 29, and 32 - 35 under 35 USC 103 over the combination of Cerezo Pancorbo et al with Artz.

On page 5 of the official action and regarding Claims 26, 28 and 32, the Examiner cites that "*Artz. et al. discloses a method of forming composite articles wherein the tooling is chosen such that it achieves a common thermal expansion with the components. The Examiner notes that Artz. et al. do not require the coefficient of thermal expansion to be the same, but only requires that they are "similar enough" to achieve a common thermal expansion*". However, the main objective of the invention of Artz. et alt, included even at the Abstract of this patent, is to obtain a material for manufacturing tools that "is easily tailored to provide a specific coefficient of thermal expansion and thermal conductivity, thus providing a tooling material that can be matched to the composite structure and material being fabricated".

On the contrary, as noted above, in the present invention the thermal expansion of the tool and the second component are different; it is the rough surface of the tool, in combination with the pressure of the vacuum bag that promotes enough friction to achieve a common expansion of both components.

Moreover, in pages 5 and 6 of the official action, and also regarding Claims 26, 28 and 32, the Examiner points out that "*the surface is machined and further, since the machined surfaces of the tool employed by either of Artz et al. achieve the desired thermal expansion, they are reasonably considered "rough enough" (i.e. are roughened)*". At this point, the examiner assumes that if the surface is machined, the surface is rough: this is not true. Furthermore, the tool described in Artz et alt. is not only machined, but finished (column 6, line 13) to obtain the desired shape, and "the machining may be accomplished with a lathe or milling machine using carbide tools, preferably at lower cutting speeds" (column 6, line 36). This is known in the state of the art as a procedure to obtain smooth surfaces in a tool. It is also known in the state of the art that in the manufacturing of composite parts using green material, the surface of the moulds has to be as smooth as possible to facilitate the de-moulding of the part. Finally, Artz el alt. even proposed that "if the porosity of the tool is greater than desired, a water-soluble sealant can be applied..." (column 6, line 43). Then, the objective of Artz et al. is to get a surface as smooth as possible, but not rough, as it is the case in the present invention.

It is therefore submitted that Claims 26, 28, 29, and 32 - 35 all meet the non-obviousness requirement of the statute. The remaining claims under consideration are all dependent on Claim 26 and so share its non-obvious features. Some comments on the Examiner's remarks on other claims may, however, be useful.

On page 8 of the official action, regarding Claims 26 and 28, the Examiner cites that "*Younie et al. discloses a method of forming composite articles wherein the tooling is chosen such that it achieves a common thermal expansion with the components. Younie et al. teach applying an exterior cover of rubber (82) aroun the aluminium tooling. As evidenced by*

Coefficients of Friction of Rubber the coefficient of friction of rubber is higher than the coefficient of friction for aluminium (table). As such, rubber is intrinsically a "friction enhancer" in Younie et al.'s tooling". As indicated in Younie et al. at column 7, line 44, "the greater coefficient of thermal expansion of the compliant cover assist the compliant cover in helping to compact and consolidate...". That is, the function of the tooling is to increase the pressure to help compacting, <u>not to increase the friction</u>, and this can be easily induced having in mind that the pressure necessary to consolidate the uncured composite part is perpendicular to the compliant cover. Furthermore, the very low stiffness of the material proposed for this compliant cover -high temperature silicon- does not allow to transfer shear loads between the tool and the pre-preg, which is an advantage of the process of the invention, since the high expansion coefficient of this material in combination with a high stiffness could promote distortions at the surface of the green material.

As to page 9 of the official action, making reference to Claim 27, in view of EP 1134070, Younie et al. as evidenced by Coefficients of Friction for Rubber, it has already been commented. The same occurs for page 10, affecting Claims 26, 27, 29, 32, 34 and 35, regarding the consideration of Artz et al. as to "rough enough".

In page 12, regarding Claims 26 and 27, the Examiner cites again that "*rubber is intrinsically a friction enhancer in Younie et al.'s tooling*". However, as it has been said previously, the stiffness of rubber is very low and cannot be used as <u>a friction enhancer</u> because it is not able to transmit shear strength. Besides, it is an state of the art knowledge in composite materials manufacturing that the procedure to consolidate green material requires applying a pressure perpendicular to the green laminate, and this is the objective of rubber, not to increase

friction.

On page 13 of the action, with regard to the objections raised for Claim 33, it is said that "*Kline et al. teach a method of producing an analogous composite material where plies of material are held in pace with grit/s and strips*". This assumption is exact, the objective being to maintain in place, but not to promote a forced expansion, as in the present invention. The objective is therefore completely different.

On page 16, regarding Claim 26, the citation of the Examiner is that "*the combination with Cerezo Pancorbo or Breur et al. with Younie et al. is a substitution combination and thus the expansion compensating tool suggested by the combination replaces the metal tool of Cerezo Pancorbo with the tool of Artz. et al.*". However, none of the tools of Cerezo, or Breur, or Younnie, or Artz, are used to force an already-cured composite component to expand more than its on expansion coefficient would do in order to allow the bonding to another component without promoting residual stresses between them.

It is therefore submitted that the requirements of 35 USC 103 have been met.

Reconsideration and allowance are, therefore, requested.

Respectfully submitted,

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